DOE/RL-2001-28
Revision 0

Radioactive Air Emissions Notice of Construction for Storage in T Plant Complex of Sludge from K Basins

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management
Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

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K If Additional Comments, Please Attach Separate Sheet

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TERMS

ALARACT	as low as reasonably achievable control technology
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BARCT	best available radionuclide control technology
CAM	continuous air monitor
CFR	Code of Federal Regulations
Ci	curie
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
DOE-RL	U.S. Department of Energy, Richland Operations Office
EPA	U.S. Environmental Protection Agency
HEPA	high-efficiency particulate air
LIGO	Laser Interferometer Gravitational Wave Observatory
MEI	maximally exposed individual
mrem	millirem
NDA	nondestructive assessment
NOC	notice of construction
RTAM	routine technical assistance meeting
SNF	spent nuclear fuel
TEDE	total effective dose equivalent
WAC	Washington Administrative Code
WDOH	Washington State Department of Health

METRIC CONVERSION CHART

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			**Volume**		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Energy			**Energy**		
kilowatt hour	3,412	British thermal unit	British thermal unit	0.000293	kilowatt hour
kilowatt	0.948	British thermal unit per second	British thermal unit per second	1.055	kilowatt
Force/Pressure			**Force/Pressure**		
pounds per square inch	6.895	kilopascals	kilopascals	0.14504	pounds per square inch

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

NOC HISTORY

The current mission of the T Plant Complex is to treat and store liquid mixed waste, store contaminated process equipment, decontaminate equipment and materials, and to store, treat, and repackage containerized waste. This mission has been ongoing since before issuance of Washington Administrative Code (WAC) 246-247, and established routine activities do not require a Notice of Construction (NOC).

A NOC was approved by the Washington State Department of Health (WDOH) for the use of high-efficiency particulate air (HEPA) vacuums to control radiological contamination at the T Plant Complex at the Routine Technical Assistance Meeting (RTAM) held on December 10, 1996. This NOC was declared obsolete on June 24, 1999, having been replaced by the Sitewide NOC for using HEPA vacuums (DOE/RL-97-50, Rev. 1).

A NOC was approved by WDOH for the upgrades to the 2706-T Building (Project W-259) at the RTAM held on June 12, 1996. This NOC was submitted to the U. S. Environmental Protection Agency (EPA), Region 10, on July 29, 1996 (96-EAP-229). EPA approval was given in a letter dated September 3, 1996 from EPA (EPA 1996a).

A NOC was approved by WDOH for the macroencapsulation of long-length equipment at the RTAM held on June 12, 1996. This NOC was submitted to the EPA, Region 10, on August 9, 1996 (96-EAP-237). EPA approval was given in a letter dated September 3, 1996 (EPA 1996b). This NOC was declared obsolete on June 24, 1999.

A NOC was submitted for the fuel removal project on November 21, 2000 (DOE/RL-2000-64, Rev. 0), but was rejected as incomplete on December 20, 2000 (WDOH 2000). The NOC was resubmitted on February 1, 2001 (DOE/RL-2000-64, Rev. 1), and approved by WDOH on March 16, 2001 (AIR 01-306). Revisions to the approval conditions in AIR 01-306 were approved by WDOH at the RTAM held on May 15, 2001. EPA approval was given in a letter dated March 21, 2001 (EPA 2001a).

A NOC was submitted to the WDOH and the EPA for the characterization of the 224-T Facility process cells (DOE/RL-2001-19, Rev. 0). This NOC identified an insignificant impact to the T Plant Complex 291-T-1 Stack. Negotiations with WDOH are in progress to clearly identify that impact. A revision to the NOC will follow when issues have been resolved.

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RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION FOR STORAGE IN T PLANT COMPLEX OF SLUDGE FROM K BASINS

This NOC describes the activities necessary to receive and store the sludge that will be removed from the K Basins and transferred to the T Plant Complex 221-T canyon for interim storage. The unabated total effective dose equivalent (TEDE) estimated for the public hypothetical maximally exposed individual (MEI) is 1.6 E+2 millirem (mrem) per year for this sludge storage NOC. The abated TEDE conservatively is estimated to account for 8.0 E-2 mrem per year to the MEI.

The following sections provide information addressing the requirements of Appendix A of WAC 246-247 (requirements 1 through 18) and 40 Code of Federal Regulations (CFR) 61.07.

1.0 LOCATION

Name and address of the facility, and location (latitude and longitude) of the emission unit:

U.S. Department of Energy, Richland Operations Office (DOE-RL)
Hanford Site,
Richland, Washington

221-T Building, 200 West Area
Latitude: 46° 33' 40.7" N
Longitude: 119° 37' 2.2" W

Figure 1 shows the location of the T Plant Complex within the 200 West Area. The exhaust stack is identified as the 291-T-1 Stack.

2.0 RESPONSIBLE MANAGER

Name, title, address and phone number of the responsible manager:

Mr. G. H. Sanders, Director,
Waste Management Division
U.S. Department of Energy, Richland Operations Office
P.O. Box 550
Richland, Washington 99352
509-372-1786

3.0 PROPOSED ACTIONS

Identify the type and proposed action for which this application is submitted.

The proposed action is considered a significant modification to an emission unit (291-T-1 Stack). The scope of this NOC for storage in the T Plant Complex 221-T canyon of sludge from K Basins includes all preparatory and operational activities required for storage of sludge containers within the 221-T canyon. The physical work activities required for sludge storage include the following:

- Decontamination of the spent fuel pool
- Physical upgrades to the 221-T canyon pool and process cells
- Fire protection upgrades to 221-T
- Radiation detection, alarm systems, and camera upgrades
- Receipt and placement of the sludge containers into interim storage at T Plant Complex
- Continuing surveillance and operations.

4.0 STATE ENVIRONMENTAL POLICY ACT

If the project is subject to the requirements of the State Environmental Policy Act (SEPA) contained in chapter 197-11 WAC, provide the name of the lead agency, lead agency contact person, and their phone number.

The proposed action categorically is exempt from the requirements of SEPA under WAC 197-11-845.

5.0 CHEMICAL AND PHYSICAL PROCESSES

Describe the chemical and physical processes upstream of the emission unit.

The chemical and physical processes associated with the sludge storage consist of the following.

- After all existing 72 fuel assemblies have been removed and the spent fuel pool water has been removed in accordance with the T Plant Complex Fuel Removal NOC (DOE/RL-2000-64, Rev. 1), the 221-T canyon spent fuel pool will be decontaminated by T Plant operation personnel. Following the activities covered in the fuel removal NOC (DOE/RL-2000-64, Rev. 1), disposal of fuel assembly racks, the filtration system, ion exchange system, and any residual contamination on the pools walls and floor will be accomplished using methods similar to existing practices within the T Plant Complex. Waste is expected to meet criteria for low-level waste.

- A new internally braced liner system is expected to be installed in the pool and in at least four of the process cells. Existing water conditioning systems (coolers, filtration system, ion exchange columns, etc.) will be used, modified, replaced, or removed.

- Spent nuclear fuel (SNF) sludge retrieved from the 105-KE and 105-KW Basins is expected to be managed as two separate waste streams. The physical and chemical characteristics of the sludge are documented in HNF-SD-SNF-TI-009. Sludge containers configured for dry storage will be used for the less reactive floor and pit sludge components, including windblown sand and rocks, spalled concrete from the basin walls, iron and aluminum corrosion products, ion exchange resin beads, uranium oxides, and possibly some uranium fuel particles. The more reactive sludge that collects in the knockout pots and settler tank during SNF retrieval and processing at K Basins is expected to require storage in a container configured for storage under water. However, blending of the two sludge waste streams is being evaluated to eliminate the need for sludge containers configured for storage under water. If this occurs, the combined streams are expected to be managed similar to the less reactive stream.

- Physical upgrades to the 221-T canyon, as determined in final design, are expected to include installation of new cell containment, liner bracing systems, sump pumps, leak detectors, and instrumentation and controls in the 221-T canyon as necessary.

- Seismic upgrades to store sludge safely are expected to be addressed by reducing loads on the pool cell walls through a lighter pool cover design.

- Fire protection alarms and automatic sprinkler systems will be upgraded in as necessary.

- Canyon radiation detectors, alarms, and cameras will be upgraded, as necessary, and will provide continued surveillance.

- Based on final design results determined in criticality and heat rejection requirements analysis, sludge containers will be designed to ensure a safe storage configuration. Final design will analyze maximum sludge loading and container sizing in an effort to minimize the number of transfers and number of containers needed. More than one type of container might be required for sludge storage. If needed, storage racks will be designed specifically to hold containers for use in the dry process cells or to hold containers for use in the pool, as determined by final design and dimensions of the sludge containers. The container storage racks will be designed to maximize the capacity and to simplify remote container placement operations.

- Sludge containers are expected to hold a layer of sludge, a layer of water, and a layer of air to provide a void space in each container. The functional design requirements of the sludge containers include the ability to maintain the sludge in a wet state during transport and storage. This will enable later removal and treatment of the sludge, which will be covered by a future NOC.

- Sludge containers will be received and placed into interim storage in the 221-T canyon, configured for dry cell storage or storage under water, as determined by final design. All movement of sludge containers within the 221-T Building will occur remotely via crane operations.

- The containers will arrive from K Basins via the transport vehicle (truck and trailer). Each transfer will consist of one transport cask that will be inspected according to approved receipt methods. One of the key aspects of this inspection will be to ensure that the external surfaces of the cask and transporter were not contaminated during transport. Once the inspection is complete and the transfer is accepted, the transport vehicle will back into the 221-T Building tunnel. The truck will be uncoupled from the trailer. The truck will remain within the Radiological Area, either inside the tunnel or outside the 221-T Building.

- Sludge container unloading operations will be done remotely using the canyon crane system. Within the controlled airspace, T Plant Complex personnel will vent and purge the transport cask with helium, remove the transport cask lid bolts, attach the lifting attachment to the cask lid, and exit the tunnel. The helium purge/venting system will include a radiation monitor to verify that the storage container maintained containment during transport and will purge all hydrogen from the transport cask. The crane operator will position the canyon crane (which will be outfitted with the appropriate cask lid grappling device), remove the cask lid, and place the lid on the trailer bed or lid stand. The crane will be repositioned and, with the appropriate lifting device, the container will be lifted out of the cask and moved into an interim storage location in the canyon pool or a dry process cell, depending on container type.

- As a sludge container is moved from the tunnel into the canyon, operations personnel will verify remotely the identification number and record the container number, via existing camera systems. After the container is removed from the cask, the lid will be replaced or placed on the trailer. The truck will re-enter the tunnel, if necessary, from the Radiological Area and connect with the trailer. The transport system will be surveyed for possible contamination on exiting the Radiological Area and will return to K Basins.

- After placing the sludge containers in the 221-T canyon interim dry storage location, continuing surveillance will be performed to ensure that safety, regulatory, and safeguards and security requirements are met. Water levels within the dry storage containers will be monitored (weight differential), and water additions will be made remotely, as necessary (Section 6.0).

- After sludge containers are placed in the interim underwater pool storage location, continuing surveillance will be performed to ensure that safety, regulatory, and safeguards and security requirements are met. Pool storage conditions (water quality, water temperature, water level, and ion exchange column status) will be monitored (Section 9.0) and provisions will be made for remote water addition to the pool.

6.0 PROPOSED CONTROLS

Describe the existing and proposed abatement technology. Describe the basis for the use of the proposed system. Include expected efficiency of each control device, and the annual average volumetric flow rate in cubic meters/second for the emission unit.

The existing 221-T ventilation system will be used (291-T-1 Stack). Two stages of HEPA filters are tested in place annually at a minimum control efficiency of 99.95 percent for each stage. Currently, the annual average flow for the 291-T-1 Stack is 15 cubic meters per second.

Both container types will be configured as right circular cylinders with a minimum of two nozzles. During storage, one nozzle will be capped (which can be removed remotely) and routinely used to add water during storage life. The other nozzle will function as a passive vent to prevent pressurization and to allow the escape of hydrogen and other gasses that might be produced chemically and radiolytically during storage. For containers to be stored in the dry process cells, the vent will be fitted with a NucFil®-type filter (rated at 99.97 percent efficiency. Any containers to be stored underwater will be fitted with a vent with a one-way valve to preclude ingress of water.

® NucFil is a registered trademark of Nuclear Filter Technology, 741 Corporate Circle, Suite R, Golden, Colorado, 80401, USA.

7.0 DRAWINGS OF CONTROLS

Provide conceptual drawings showing all applicable control technology components from the point of entry of radionuclides into the vapor space to release to the environment.

Figure 2 shows the existing ventilation system for the 291-T-1 Stack. Final conceptual design drawings for sludge containers will be provided to WDOH when available.

8.0 RADIONUCLIDES OF CONCERN

Identify each radionuclide that could contribute greater than ten percent of the potential to emit TEDE to the MEI, or greater than 0.1 mrem/yr potential to emit TEDE to the MEI.

Any radionuclide might be present in the T Plant Complex from historical operations. The radionuclides of concern for this sludge storage NOC are strontium-90 (>0.1 mrem/yr), cesium-137 (>0.1 mrem/yr), europium-154 (>0.1 mrem/yr), uranium-234 (>0.1 mrem/yr), plutonium-238 (>0.1 mrem/yr), plutonium-239/240 (>10 percent), plutonium-241 (>0.1 mrem/yr), and americium-241 (>10 percent).

9.0 MONITORING

Describe the effluent monitoring system for the proposed control system. Describe each piece of monitoring equipment and its monitoring capability, including detection limits, for each radionuclide that could contribute greater than ten percent of the potential to emit TEDE to the MEI, or greater than 0.1 mrem/yr potential to emit TEDE to the MEI, or greater than twenty-five percent of the TEDE to the MEI, after controls. Describe the method for monitoring or calculating those radionuclide emissions. Describe the method with sufficient detail to demonstrate compliance with the applicable requirements.

The proposed operations will be subject to continuous monitoring requirements specified in 40 CFR 61.93 and WAC 246-247. Nondestructive assessment (NDA) will be performed annually on the final stage of HEPA filters for the 291-T-1 Stack. NDA consists of in situ high-resolution gamma spectrometry, in accordance with Method G-1, as described in 40 CFR 61, Appendix B, Method 114. The NDA measurements are proposed as an alternative method for continuous sampling, in accordance with allowance for such approvals per 40 CFR 61.93.

The annual NDA measurements on the final stage of the HEPA filters provide a 100 percent sample of the annual airflow from the entire 221-T Building. These results will be reported as the annual emissions from the 221-T canyon operations.

In addition, to provide periodic confirmatory measurement for any emissions due to residual contamination downstream of the filter system, the record sampler for the 291-T-1 Stack is operated continuously, and particulate sample air filters are collected biweekly. The biweekly samples are analyzed for gross alpha/beta activity and composited quarterly for specific isotopic analysis (strontium-90, cesium-137, europium-154, plutonium-238, plutonium-239/240, and americium-241). Uranium-234 and plutonium-241 emissions are not measured directly, but are included in the gross alpha/beta analysis and the gamma scan on the quarterly composites. The emissions from resuspended legacy contamination downstream of the filter system will be represented by these samples. Continuous sampling addresses the emission impacts to the 291-T-1 Stack from the 224-T process cells characterization NOC (DOE/RL-2001-19).

The alpha continuous air monitor (CAM) and the beta/gamma CAM for the 291-T-1 Stack will be reactivated before sludge containers are received in the 221-T canyon. These CAMs will provide alarm capability for any releases above alarm setpoints.

Monitoring for sludge container integrity will be provided. Sludge containers configured for dry storage will have spill containment, leak detection, and the ability for addition of makeup water. Sludge containers configured for wet storage will not require makeup water; however, the pool water quality will be monitored continuously using an in-line radiation detector, which will provide leak detection capability.

10.0 ANNUAL POSSESSION QUANTITY

Indicate the annual possession quantity for each radionuclide.

Table 1 summarizes the inventory at the T Plant Complex addressed by this sludge storage NOC.

10.1 Spent Fuel Pool Decontamination

Decontamination of the spent fuel pool will have minimal impact to the inventory listed in Table 1. Based on contamination levels in the 221-T canyon, general contamination levels on the pool floor and walls are not expected to exceed 20,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2) alpha contamination or 1,000,000 dpm/100 cm^2 beta/gamma emitting contamination. These levels are 10 times the posting limit for a high contamination area as listed in the radiological control manual (HNF-5713). The surface area of the pool floor and walls is approximately 244 square meters. To account for the surface area of the racks and equipment in the pool, doubling the surface area and rounding up to 500 square meters provides a conservative total surface area. Multiplying the total surface area by bounding average contamination levels (20,000 dpm/100 cm^2 alpha and 1,000,000 dpm/100 cm^2 beta/gamma) of the pool floor and walls results in an estimated bounding inventory of 4.5 E-4 Ci alpha contamination (as americium-241) and 2.3 E-2 Ci beta/gamma emitting contamination (as strontium-90). This bounding inventory is over six orders of magnitude lower than the sludge inventory in Table 1; thus, the spent fuel pool decontamination inventory will not affect the significant digits of the sludge inventory shown.

10.2 Sludge from K Basins

Extensive characterization of the sludge from K East and K West Basins has been described in HNF-SD-SNF-TI-009. The most recent estimate for the total sludge inventory (nominal or expected values) is 107,000 Ci. Bounding values for design and safety considerations are being evaluated; however, those bounding values will be less than a factor of 4. Thus, the nominal values in HNF-SD-SNF-TI-009 conservatively were multiplied by 4 to provide the bounding inventory values listed in Table 1. Tritium and krypton-85 were not addressed in HNF-SD-SNF-TI-009, so an estimate was made using the tritium and krypton-85 values listed in the NOCs for K East Basin (DOE/RL-96-101) and K West Basin (DOE/RL-97-28). The combined tritium and krypton-85 values listed in Table 7-1 in each of the K Basins NOCs were 3.75 E+4 Ci and 6.07 E+5 Ci respectively. These values were multiplied by the total sludge inventory in Table 1 of this NOC (1.08 E+5 Ci) and divided by the total fuel and sludge inventory in the K Basins NOCs (5.47 E+7 Ci). Results of these calculations are shown in Table 1.

11.0 PHYSICAL FORM

Indicate the physical form of each radionuclide in inventory: Solid, particulate solids, liquid, or gas.

The physical form of each radionuclide of concern in the inventory is listed in Table 1.

12.0 RELEASE FORM

Indicate the release form of each radionuclide in inventory: Particulate solids, vapor or gas. Give the chemical form and ICRP 30 solubility class, if known.

All emissions from the radionuclides in the inventory presented in Table 1 are assumed released as particulate solids, with the exception of tritium and krypton-85, which are assumed released as a gas.

13.0 RELEASE RATES

Give the predicted release rates without any emissions control equipment (potential to emit) and with the proposed control equipment using the efficiencies described in subsection (6) of this section. Indicate whether the emission unit is operating in a batch or continuous mode.

The predicted release rates for each radionuclide, without any emissions control equipment (unabated), are presented in Table 1 using the appropriate WAC 246-247-030 (21)(a) release fractions (1.0 E-3 for particulate solids and liquids and 1.0 for gases). The total potential release rates for these radionuclides (unabated) are summarized in Table 2. The predicted release rates using the control equipment efficiencies in Section 6.0 (abated) also are presented in Table 2.

Actual emissions for 1999 from the 291-T-1 Stack were 3.7 E-5 Ci of total alpha and 1.3 E-4 Ci of total beta/gamma. The 291-T-1 Stack will operate in continuous mode; however, the proposed activities in this NOC are not expected to result in a measurable change of actual emissions from the 291-T-1 Stack.

14.0 LOCATION OF MAXIMALLY EXPOSED INDIVIDUAL

Identify the MEI by distance and direction from the emission unit.

The MEI from the T Plant Complex is located at the Laser Interferometer Gravitational Wave Observatory (LIGO), approximately 18.3 kilometers east southeast of the Reduction Oxidation Facility (S Plant), conservatively chosen to represent 200 West Area. Dose estimates for unit Ci releases of selected radionuclides were calculated for emissions from the 200 West Area. These dose estimates were calculated for an onsite member of the public working at LIGO.

15.0 TOTAL EFFECTIVE DOSE EQUIVALENT TO THE MAXIMALLY EXPOSED INDIVIDUAL

Calculate the TEDE to the MEI using an approved procedure. For each radionuclide identified in sub section (8) of this section, determine the TEDE to the MEI for existing and proposed emission controls, and without any existing controls using the release rates from subsection 13 of this section. Provide all input data used in the calculations.

The calculations for the TEDE to the MEI are summarized in Table 2. The total unabated dose for this NOC conservatively is estimated to be 1.6 E+2 mrem per year to the MEI, with a total abated dose estimate of 8.0 E-2 mrem per year to the MEI.

Use of the Hanford Site specific parameters for dose modeling calculations was approved by the EPA (EPA 2001b) and WDOH (AIR 01-308). The CAP88-PC dose modeling calculations, Hanford Site defaults, and unit dose factors used in this NOC are the same as those provided in the Fuel Removal NOC (DOE/RL-2000-64, Rev. 1).

16.0 COST FACTOR IF NO ANALYSIS

Provide cost factors for construction, operation and maintenance of the proposed control technology components and the system, if a BARCT or ALARACT demonstration is not submitted with the NOC.

Pursuant to WAC 246-247-110, App. A (16), cost factors for construction, operation, and maintenance of proposed technology requirements are not required, as the following is provided as a best available radionuclide control technology (BARCT) demonstration.

WDOH has provided guidance that HEPA filters generally are BARCT for particulate emissions (AIR 92-107). Because the radionuclides of concern are particulates, it is proposed that the controls described in Section 6.0 for the 291-T-1 Stack be accepted as BARCT. Compliance with the substantive BARCT standards is described in Section 18.0.

17.0 DURATION OR LIFETIME

Provide an estimate of the lifetime for the facility process with the emission rates provided in this application.

Procurement of sludge containers and/or racks is scheduled to begin October 2001. Upgrades to the canyon will begin after removal of the fuel assemblies (DOE/RL-2000-64, Rev.1) is complete. Receipt of the sludge containers that will be placed in dry storage process cells is scheduled for January 2003. The sludge containers will be kept in interim storage at the T Plant Complex for up to 30 years.

18.0 STANDARDS

Indicate which of the following control technology standards have been considered and will be complied with in the design and operation of the emission unit described in this application:

ASME/ANSI AG-1, ASME/ANSI N509, ASME/ANSI N510, ANSI/ASME NQA-1, 40 CFR 60, Appendix A Methods 1, 1A, 2, 2A, 2C, 2D, 4, 5, and 17, and ANSI N13.1

For each standard not so indicated, give reasons to support adequacy of the design and operation of the emission unit as proposed.

The abatement control system for the 291-T-1 Stack was installed in the early 1990's before this requirement for control technology standards was specified in WAC 246-247 (April 1994). Although the listed technology standards, if available at time of construction, might have been followed as guidance, there was no regulatory requirement for compliance with the listed standards. Operational history, routine maintenance, testing, and inspections were used to demonstrate adequacy of the design and operation of the existing abatement control technology as approved for the fuel removal NOC (DOE/RL-2000-64, Rev. 1). This sludge storage NOC, as required by approval Condition # 37 (AIR 01-306) shows a higher degree of documentation and evidence of compliance to the standards. A technology standards assessment (HNF-8231) was performed to demonstrate that the substantive requirements of the standards are met. A matrix of the requirements, any deviations from the standards, and justification for any deviations are provided in the assessment, which demonstrates the status of conformance by the ventilation and monitoring systems.

- ASME/ANSI AG-1 (first promulgated in 1985, and revised in 1991, 1994, and 1997):

The section in AG-1 (Section FC) that covers HEPA filters is applicable to replacement filters for the 291-T-1 Stack ventilation system. Replacement filters (HNF-S-0552, *Specification for Procurement and Onsite Storage of Nuclear Grade High-Efficiency Particulate Air (HEPA) Filters*) are nuclear grade HEPA filters that meet all applicable AG-1 except the requirement dealing with filter qualification testing. Justification for this sitewide exception was discussed with WDOH at the December 1998 RTAM and was approved by WDOH. A WDOH-approved temporary deviation is currently in place to satisfy this issue (AIR 99-507).

Compliance with the other sections of AG-1 is addressed in the technology standards assessment (HNF-8231), along with justification for any deviations.

- ASME/ANSI N509 (first promulgated in 1976, and revised in 1980 and 1989):

The ventilation system meets the substantive requirements of ANSI N509. Documentation to show compliance is provided in the technology standards assessment (HNF-8231), along with justification for any deviations.

Adequacy of the HEPA filters and housings has been demonstrated by operational history and successful testing in accordance with guidance provided in ASME/ANSI N510. The existing system has been successfully tested annually in its current configuration since 1995.

- ASME/ANSI N510 (first promulgated in 1975, and revised in 1980 and 1989):

Testing procedures meet the substantive requirements of ANSI N510, as described in the technology standards assessment (HNF-8231). To demonstrate the adequacy of the system design and operation, both stages of HEPA filters are aerosol tested individually in-place annually (at a minimum control efficiency of 99.95 percent) to meet the requirements of ANSI N510. This annual testing includes a visual inspection of the housing as described in ANSI N510.

- ANSI/ASME NQA-1 (*first promulgated in 1985*):

NQA-1 sections addressing abatement technology components design are addressed in the technology standards assessment (HNF-8231). Quality assurance for sampling of emissions and subsequent analysis is addressed in HNF-0528, *NESHAP Quality Assurance Project Plan for Radioactive Airborne Emissions* (all of Sections 2.0, 3.0 and 5.0), which was written in accordance with applicable NQA-1 requirements.

- ANSI/ASME NQA-2:

The standard is no longer an active National Standard and has been incorporated into NQA-1. Compliance compatible with NQA-1 was described previously.

- 40 CFR 60, Appendix A

Stack flow is tested using Methods 1 and 2. Methods 1A, 2A, 2C, and 2D are not applicable to the stack dimensions/design. Relative humidity (as allowed in Method 2) is measured with a calibrated hygrometer or with wet and dry bulb readings. Methods 4, 5, and 17, which provide a method for measuring relative humidity for combustion sources, are not applicable to radioactive airborne effluent stacks.

- ANSI N13.1:

The annual NDA measurements described in Section 9.0 on the final stage of HEPA filters are proposed as an alternative method to the new ANSI/HPS N13.1-1999 requirements. The final stage of HEPA filters provides 100 percent sampling of the flow from the 221-T canyon, which exceeds the requirements of the standard. The NDA results for loading of radionuclides on the final stage of HEPA filters are treated as the samples, representing the emissions released during the year.

The existing record sampling system, operated continuously as described in Section 9.0, complies with the substantive requirements of ANSI N13.1 (1969). The stack probe, a rake design with 10 nozzles, was installed in the mid-1980's. The nozzles do measure equal annular area as described in the standard. The radius of curvature for the probe nozzles is approximately 4R, so the ANSI N13.1 (1969) criterion of 5R is not met; however, the ANSI/HPS N13.1-1999 criterion was changed to 3R, which is met. The probe location meets the minimum requirement of five stack diameters downstream from abrupt changes in flow direction. Sample tubing and number of bends are minimized as much as physically practical. The probe was designed to provide near isokinetic sampling at a given stack flow. The stack is operated to maintain near isokinetic sampling. Currently the sample system is operated continuously to provide periodic confirmatory measurement for any emissions due to residual contamination downstream of the filter system.

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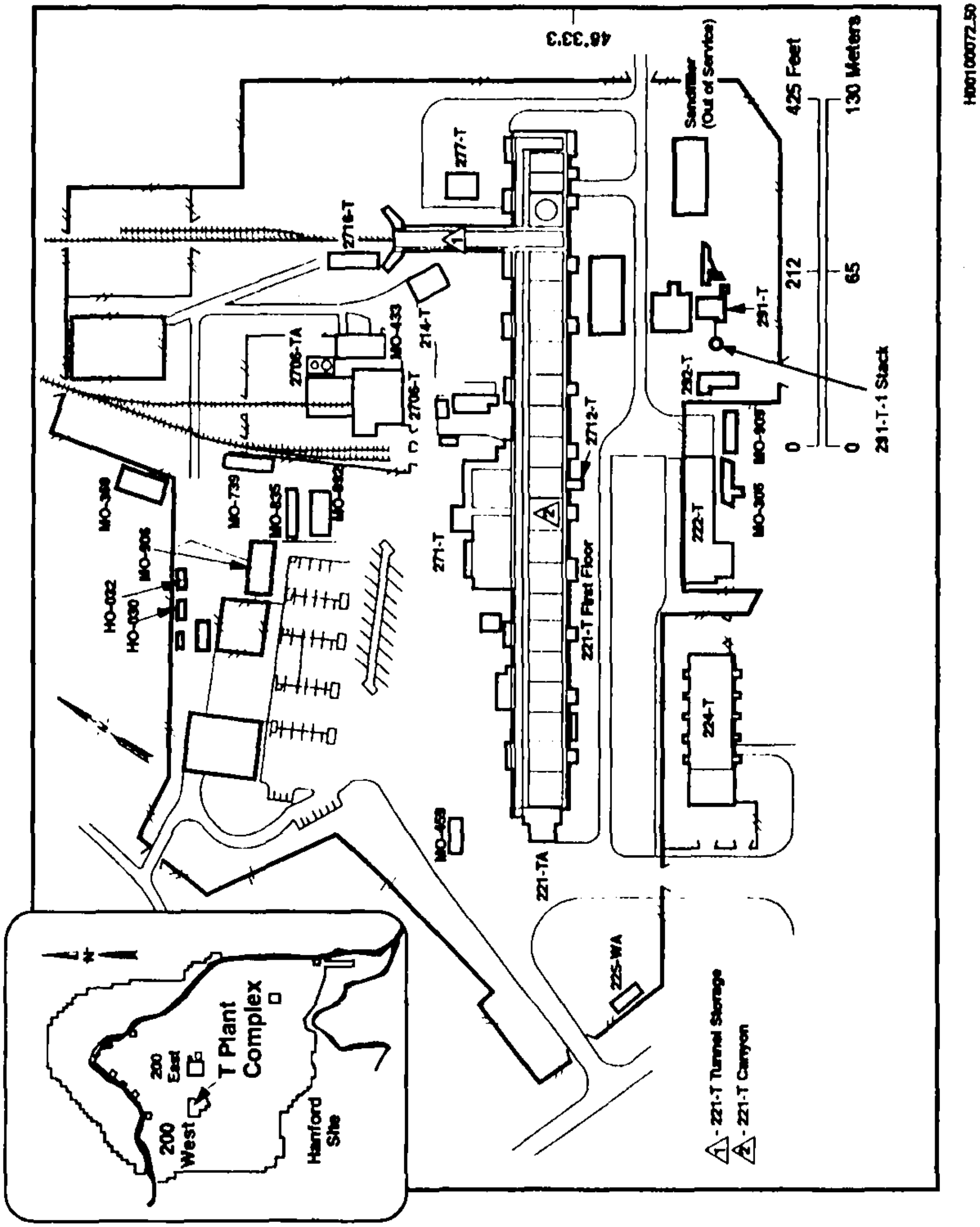

Figure 1. Location of T Plant Complex and the 291-T-1 Stack in the 200 West Area.

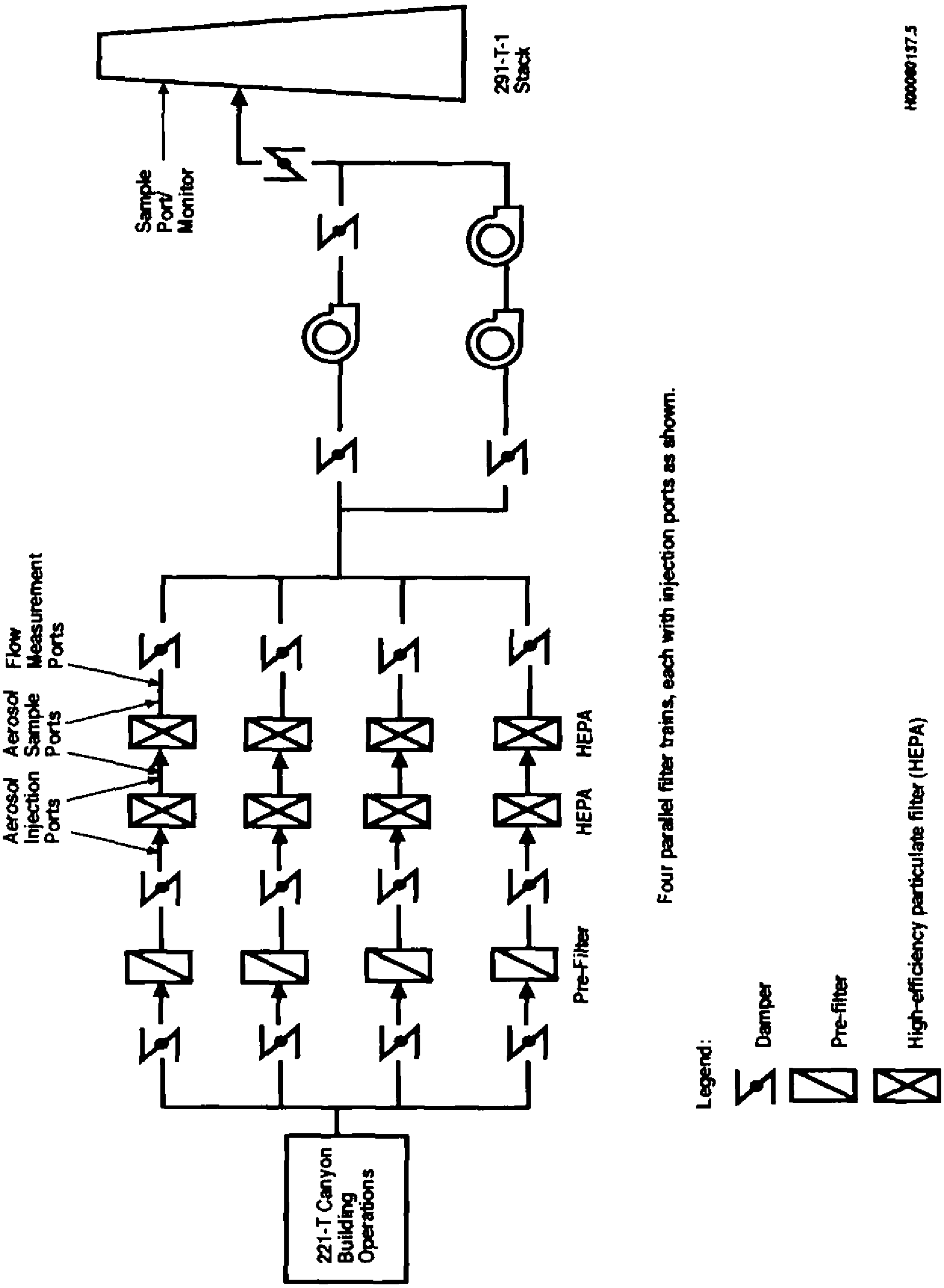

Figure 2. Ventilation Flow Diagram for the 291-T-1 Stack.

Table 1. T Plant Complex Storage Inventory of Sludge from K Basins

Radionuclides	Physical form	Inventory * (Ci)	Bounding * inventory (Ci)	Release factor	Potential release (Ci)
H-3 **	gas	7.34 E+1	2.93 E+2	1.0 E+0	2.93 E+2
Co-60	particulate	7.81 E+1	3.12 E+2	1.0 E-3	3.12 E-1
Kr-85 **	gas	1.19 E+3	4.75 E+3	1.0 E+0	4.75 E+3
Sr--89/90	particulate	3.42 E+4	1.37 E+5	1.0 E-3	1.37 E+2
Tc-99	particulate	5.59 E+1	2.24 E+2	1.0 E-3	2.24 E-1
Cs-134	particulate	2.26 E+1	9.04 E+1	1.0 E-3	9.04 E-2
Cs-137	particulate	3.43 E+4	1.37 E+5	1.0 E-3	1.37 E+2
Eu-152	particulate	4.76 E+0	1.90 E+1	1.0 E-3	1.90 E-2
Eu-154	particulate	2.88 E+2	1.15 E+3	1.0 E-3	1.15 E+0
Eu-155	particulate	1.08 E+2	4.30 E+2	1.0 E-3	4.30 E-1
U-234	particulate	5.39 E+1	2.16 E+2	1.0 E-3	2.16 E-1
U-235	particulate	1.90 E-1	7.59 E-1	1.0 E-3	7.59 E-4
U-236	particulate	6.20 E+0	2.48 E+0	1.0 E-3	2.48 E-3
Np-237	particulate	2.43 E-1	9.71 E-1	1.0 E-3	9.71 E-4
U-238	particulate	3.22 E+0	1.29 E+1	1.0 E-3	1.29 E-2
Pu-238	particulate	3.61 E+2	1.44 E+3	1.0 E-3	1.44 E+0
Pu-239/240	particulate	1.85 E+3	7.38 E+3	1.0 E-3	7.38 E+0
Pu-241	particulate	3.35 E+4	1.34 E+5	1.0 E-3	1.34 E-2
Am-241	particulate	1.73 E+3	6.92 E+3	1.0 E-3	6.92 E+0
Total		1.08 E+5	4.31 E+5		

* Inventory data for radionuclides are taken from HNF-SD-SNF-TI-009, Rev. 4, Table 2-1 and Table 2-2, using the nominal values. These values were multiplied by a factor of 4 to provide bounding data for safety and design considerations.

** Tritium and krypton-85 values are taken from the fuel//sludge inventories from K East and K West (Table 7-1 of DOE/RL-96-101 and Table 7-1 of DOE/RL-97-28, respectively), multiplied by the sludge: fuel ratio of 1.07 E+5: 5.47 E+7 to obtain values for the sludge inventory.

Table 2. T Plant Complex Storage Inventory of Sludge from K Basins Potential to Emit.

Radionuclides	Potential unabated release (Ci/yr)	Potential abated release (Ci/yr)	Dose factor CAP88-PC* (mrem/Ci)	Unabated offsite dose (mrem/yr)	Abated offsite dose (mrem/yr)
H-3	2.93 E+2	2.93 E+2	5.65 E-6	1.66 E-3	1.66 E-3
Co-60	3.12 E-1	1.56 E-4	2.33 E-1	7.27 E-2	3.63 E-5
Kr-85	4.75 E+3	4.75 E+3	4.78 E-8	2.27 E-4	2.27 E-4
Sr--89/90	1.37 E+2	6.85 E-2	8.71 E-3	1.19 E+0	5.97 E-4
Tc-99	2.24 E-1	1.12 E-4	1.71 E-3	3.83 E-4	1.92 E-7
Cs-134	9.04 E-2	4.52 E-5	7.02 E-2	6.35 E-3	3.17 E-6
Cs-137	1.37 E+2	6.85 E-2	2.09 E-3	2.86 E-1	1.43 E-4
Eu-152	1.90 E-2	9.50 E-6	.235 E-1	4.47 E-3	2.23 E-6
Eu-154	1.15 E+0	5.75 E-4	1.9 E-1	2.19 E-1	1.09 E-4
Eu-155	4.30 E-1	2.15 E-4	7.43E-3	3.19 E-3	1.60 E-6
U-234	2.16 E-1	1.08 E-4	2.72 E+0	5.88 E-1	2.94 E-4
U-235	7.59 E-4	3.80 E-7	2.59 E+0	1.97 E-3	9.84 E-7
U-236	2.48 E-3	1.24 E-6	2.57 E+0	6.37 E-3	3.19 E-6
Np-237	9.71 E-4	4.86 E-7	1.01 E+1	9.81 E-3	4.91 E-6
U-238	1.29 E-2	6.45 E-6	2.41 E+0	3.11 E-2	1.55 E-5
Pu-238	1.44 E+0	7.20 E-4	6.53 E+0	9.40 E+0	4.70 E-3
Pu-239/240	7.38 E+0	3.69 E-3	7.02 E+0	5.18 E+1	2.59 E-2
Pu-241	1.34 E+2	6.70 E-2	1.07 E-1	1.43 E+1	7.17 E-3
Am-241	6.92 E+0	3.46 E-3	1.12 E+1	7.75 E+1	3.88 E-2
Total				1.55 E+2	7.97 E-2

* DOE/RL-2000-64, Rev. 1, Attachment 1.

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